National Institute of Environmental Health Sciences

Bayesian modelling of the effect of climate on malaria in Burundi

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Abstract:

BACKGROUND: In Burundi, malaria is a major public health issue in terms of both morbidity and mortality with around 2.5 million clinical cases and more than 15,000 deaths each year. It is the single main cause of mortality in pregnant women and children below five years of age. Due to the severe health and economic cost of malaria, there is still a growing need for methods that will help to understand the influencing factors. Several studies have been done on the subject yielding different results as which factors are most responsible for the increase in malaria. The purpose of this study has been to undertake a spatial/longitudinal statistical analysis to identify important climatic variables that influence malaria incidences in Burundi. METHODS: This paper investigates the effects of climate on malaria in Burundi. For the period 1996-2007, real monthly data on both malaria epidemiology and climate in the area of Burundi are described and analysed. From this analysis, a mathematical model is derived and proposed to assess which variables significantly influence malaria incidences in Burundi. The proposed modelling is based on both generalized linear models (GLM) and generalized additive mixed models (GAMM). The modelling is fully Bayesian and inference is carried out by Markov Chain Monte Carlo (MCMC) techniques. RESULTS: The results obtained from the proposed models are discussed and it is found that malaria incidence in a given month in Burundi is strongly positively associated with the minimum temperature of the previous month. In contrast, it is found that rainfall and maximum temperature in a given month have a possible negative effect on malaria incidence of the same month. CONCLUSIONS: This study has exploited available real monthly data on malaria and climate over 12 years in Burundi to derive and propose a regression modelling to assess climatic factors that are associated with monthly malaria incidence. The results obtained from the proposed models suggest a strong positive association between malaria incidence in a given month and the minimum temperature (night temperature) of the previous month. An open question is, therefore, how to cope with high temperatures at night.

Source: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2885398

Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Meteorological Factors, Precipitation, Temperature

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location: ☑

resource focuses on specific location

Non-United States

Non-United States: Africa

African Region/Country: African Country

Other African Country: Burundi

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Vectorborne Disease

Vectorborne Disease: Mosquito-borne Disease

Mosquito-borne Disease: Malaria

Mitigation/Adaptation: ☑

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology: ☑

type of model used or methodology development is a focus of resource

Outcome Change Prediction

Population of Concern: A focus of content

Resource Type: ☑

format or standard characteristic of resource

Research Article

Timescale: ☑

time period studied

Short-Term (

Vulnerability/Impact Assessment: ☑

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content